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10/747,626	12/30/2003	Fleming Y.-M. Lure	22373-00006-US2	2907

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EXAMINER

BLOOM, NATHAN J

ART UNIT	PAPER NUMBER
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2624

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/747,626	Applicant(s) LURE ET AL.	
	Examiner Nathan Bloom	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 and 24-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-22 and 24-28 is/are rejected.
- 7) ☐ Claim(s) 23 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Claim Objections

1. Claim 23 is objected to because of the following informalities: Claim number 23 is absent from this application, and its absence is currently viewed as an error in the numbering of the claims. Appropriate correction is required.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 15 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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3. Claim 15 recites the limitation "said generating" in the 2nd line of the claim. There is insufficient antecedent basis for this limitation in the claim. It appears that this claim should be dependent on instant claim 14, and in the interest of furthering the prosecution claim 15 will be treated as dependent on instant claim 14 in this office action. Please make appropriate corrections.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-2, 7-9, 13-14, 16-17, 19-22, and 24-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Xu (US 6363163).

Instant claim 1: A method of processing radiological images, comprising: registering first and second different radiological image sets, said first and second radiological image sets being obtained from a common portion of a common subject to generate a registered second radiological image set and a set of image parameters of said second radiological image set, the image parameters describing a shift of said second radiological image set relative to said first radiological image set [*Column 7 lines 25-34: matching the images such that images in 2nd set correspond to images in 1st set and aligns (shifts) current image set with previous image set.*]

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Column 7 lines 35+ and column 8 lines 1-9: image parameters = shift and rotational parameters]; and

performing a temporal comparison using said image parameters, said registered second radiological image set, and said first radiological image set [*Column 8 lines 53-64: subtraction of 1st image set and registered 2nd image set (registered image set has been created using image parameters)*].

Instant claim 2: The method according to claim 1, wherein said registering comprises: performing body part registration [*Column 7 lines 35-53: images are of lungs and thoracic sections*].

Instant claim 7: The method according to claim 2, wherein said body part registration comprises: segmenting said first and second sets of radiological images to produce first and second sets of segmented radiological images [*Column 7 lines 35-53, Column 8 lines 10-52 and Figures 7A and 7B: Images are divided up (segmented) into regions of interest for further registration.*];

registering at least one segmented anatomic region of said second set of segmented radiological images with said first set of segmented radiological images to produce a registered second set of segmented radiological images [*Column 7 lines 35-53 and Column 8 lines 10-52: Images are divided up (segmented) into regions of interest for further registration.*]; and

combining said registered second set of segmented radiological images to produce said registered radiological image set and said image parameters [*Column 7 lines 35-53 and Column 8 lines 10-*

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43: Segments (ROIs) are removed and matched to 1st image, after position/orientation of each is found then the 2nd image is constructed appropriately.].

Instant claim 8: The method according to claim 7, wherein said segmenting further comprises: performing an anatomic region segmentation on said first and second sets of segmented radiological images to produce first and second sets of anatomic region image segments [*Column 7 lines 35-53 and Column 8 lines 10-52 and Figures 7A and 7B: Images are divided up (segmented) into regions of interest for further registration, anatomic region has been defined as any subdivision of an image volume (page 8 paragraph 00031 of application.].*

Instant claim 9: The method according to claim 8, wherein said registering comprises: registering corresponding anatomic region image segments from said first and second sets of anatomic region image segments [Column 7 lines 35-53, and Column 8 lines 10-52].

Instant claim 13: The method according to claim 1, further comprising: applying at least one computer-aided detection (CAD) system to each of said first and second radiological image sets to produce first and second detection results, respectively; performing location adjustment on said second detection results, using said image parameters, to produce registered second detection results; and temporally comparing said first detection results and said registered second detection results [*As per column 3 lines 41-54 this method can be implemented to be performed by a computer program and thus a computer-aided detection system was used].*

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Instant claim 14: The method according to claim 1, further comprising: generating said first and second sets of radiological images [*Column 2 lines 35-39: Image sets are obtained (must have been generated first) and the generation of these images were known in the art at the time of the invention.*].

Instant claim 16: 16. A computer-readable medium containing software code that, when executed by a computing platform, causes the computing platform to perform the method according to claim 1 [*See rejection of instant claim 1 and Column 3 lines 35-41.*].

Instant claim 17: The method according to claim 16, wherein said registering comprises: performing body part registration [*See rejection of instant claim 2 and Column 3 lines 35-41.*].

Instant claim 19: The method according to claim 16, further comprising: applying at least one computer-aided detection (CAD) system to each of said first and second radiological image sets to produce first and second detection results, respectively; performing location adjustment on said second detection results, using said image parameters, to produce registered second detection results; and temporally comparing said first detection results and said registered second detection results [*As per column 3 lines 41-54 this method can be implemented to be performed by a computer program and thus a computer-aided detection system was used*].

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Instant claim 20: A computer system adapted to perform the method according to claim 1 [*See rejection of instant claim 3 and Column 3 lines 41-54.*].

Instant claims 21 and 22 claim the system that accomplishes the methods of instant claims 1 and 3. As per rejection of instant claim 1 and 3 and column 3 lines 41-54 Xu has disclosed the system and method.

Instant claims 24-26 correspond to the system that accomplishes the method of instant claims 7-9. As per rejection of instant claims 7-9 and column 3 lines 41-54 Xu has disclosed the system that accomplishes the described method.

Instant claim 27: The system according to claim 21, further comprising: at least one computer-aided diagnosis (CAD) system adapted to process said first set of radiological images and said second set of radiological images to produce first and second detection results, respectively; a location adjustor adapted to receive said second detection results and to receive said image parameters, the location adjustor applying said image parameters to said second detection results to produce registered second detection results; and a temporal comparator adapted to receive and to compare said first detection results and said registered second detection results. [*As per column 3 lines 41-54 this method can be implemented to be performed by a computer program and system and thus the use of a computer-aided detection system has been disclosed.*]

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Instant claim 28: The system according to claim 27, further comprising: means for generating said first and second sets of radiological images [*As per rejection of instant claim 14 the means for generating the images was known to one of ordinary skill in the art.*].

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 3-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu in view of Shen (US 6738063).

Instant claim 3: The method according to claim 2, wherein said registering further comprises:

performing the following steps, prior to said body part registration, if the second set of radiological images only partially covers an area under consideration:

performing slice matching of said second set of radiological images, relative to said first set of radiological images [*Xu teaches in column 7 lines 25-34 the matching the sets such that slices in 2nd set correspond to slices in 1st set, but does not teach anything more than a one to one correspondence based on correlation. However, Shen in column 4 lines 4-20 teaches the shift in the z direction by cross-correlating data from the images.*] and

determining top and bottom positions of said second set of radiological images [*Shen in column 4 lines 5-10 teaches the alignment (positioning) of the 2nd set relative to the 1st set thus*

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establishing a relative alignment between the slices of the 1st and 2nd sets. Furthermore, since the relative positions of each slice in the 2nd set is known then the positions of the top and bottom slices of the 2nd set are known relatives to the 1st set. It would have been obvious to one of ordinary skill in the art to combine Xu and Shen, whom both teach alignment of the CT slices, to increase the correlation accuracy of the system by more accurately delineating between the organ and its surrounding area.]

Instant claim 4: The method according to claim 3, wherein said slice matching comprises: determining a correlation length between said first and second sets of radiological images [*Shen teach in column 4 lines 4-20 a shift in the z direction based on the cross-correlation of the slices. This shift is the same as the correlation length.*]; and shifting one of said sets of radiological images relative to the other [*see same passage*].

Instant claim 5: The method according to claim 4, wherein said common portion comprises a lung region, and wherein said determining a correlation length comprises: performing lung segmentation on each of said first and second sets of radiological images to determine lung fields and contours of said first and second sets of radiological images [*Xu in Column 6 lines 11-19 thresholds the image to separate out the desired anatomic region, but does not specifically refer to the segmentation and contouring of these areas. However, Shen column 4 lines 5-10, specifically refers to the segmentation of the anatomic regions by thresholding techniques and boundary tracing.*];

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for each of said first and second sets of radiological images, generating values of a lung-to-tissue ratio for a multiplicity of regions, based on said lung fields and contours, to produce first and second lung-to-tissue ratio curves corresponding to said first and second sets of radiological images [*Shen lines 5-20, lung volume and relative lung area are equivalent to the lung-to-tissue ratio as they all represent a measure of the lung area in the particular 2-D image (Xu teaches relative lung areas).*];

cross-correlating at least a portion of each of said first and second lung-to-tissue ratio curves to obtain a correlation curve [*Shen column 4 lines 11-20, peak point refers to peak correlation point of the curve. Xu refers to the use of a correlation curve in column 4 lines 27-52*]; and determining said correlation length based on said correlation curve [*Same sections of Xu and Shen: shift in the z direction is the correlation length*].

Instant claim 6: The method according to claim 5, wherein said determining said correlation length comprises: determining a maximum value of said correlation curve and determining said correlation length to be a shift corresponding to said maximum value [*See sections referred to in the rejection of claim 5: peak correlation is the shift in the z direction*].

8. Claims 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu in view of Hsu (US 6795521).

Instant claim 10: The method according to claim 9, wherein said registering corresponding

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anatomic region image segments comprises: identifying anatomical landmarks in said first and second sets of anatomic region image segments [*Hsu in column 6 lines 56+ and column 7 lines 1-5: Hsu is admitted by applicant in paragraph 00033 as describing the identification matching of structures.*];

classifying each anatomical landmark as a global landmark or as a fine structure; and matching at least one of said global landmarks [*Hsu in column 7 lines 6-51: Anatomical landmarks are classified based on likelihood of fitting the parameters for the object in question.*].

Instant claim 11: The method according to claim 10, wherein said registering corresponding anatomic region image segments further comprises: matching at least one of said fine structures [*Hsu in column 7 lines 6-51: Structures are identified (matched) in the two sets of images based on calculated values. In particular see lines 6-19 and 27-35.*].

Instant claim 12: The method according to claim 10, wherein said identifying anatomical landmarks comprises:

performing edge enhancement [*Xu: column 5 lines 49-62, known to one of ordinary skill in the art as is evidenced by Sonka ("Image Processing, Analysis, and Machine Vision") pages 135-137 section 5.2.1*];

performing border connection [*Sonka: It was known to one of ordinary skill in the art to further enhance segmented edges by connecting (edge confidence Section 5.2.2), eliminating (edge relaxation Section 5.2.2), and sharpening the edge as is evidenced by Sonka in pages 135-175.*];

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eliminating insignificant edges [*Known to one of ordinary skill in the art as evidenced by section 5.2.2 of Sonka.*]; and

enhancing remaining edges [*Known to one of ordinary skill in the art to apply a sharpening filter to enhance contour from surroundings as is evidenced by Sonka in pages 135-175.*].

Instant claim 18 encompasses the method as described in claim 3 stored on a computer readable medium and as per rejection of claim 3 the method has been disclosed by Xu in view of Shen. Furthermore, Xu has disclosed the storing of these methods for execution in column 3 lines 35-41.

9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xu in view of Oosawa (US 7035445).

Instant claim 15: The method according to claim 14, wherein said common portion comprises a lung region and wherein said generating comprises, for each of said first and second sets of radiological images:

extracting a thoracic body region from a set of three-dimensional computer tomography (CT) images [*Xu figures 2-7 depict images of the thoracic obtained from a 3-D CT*];

extracting a lung region from said thoracic body region; [*Xu figures 2-7 shows the extracted lung regions.*]

separately extracting soft tissue regions and bone regions from said lung region [*Xu does not disclose the method of separating soft tissue from the bone regions for further image enhancement. However, Oosawa in column 11 lines 45+, and in more detail throughout the*

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remainder of the disclosure, discloses in an energy subtraction method for CT images in which the bone and soft tissue are separately extracted. It would have been obvious to combine Xu with Oosawa to obtain a clearer image for diagnosing.]; and separately interpolating said soft tissue regions and said bone regions to produce interpolated soft tissue regions and bone regions [Oosawa column 11 lines 9-31 and 45+]; and performing frontal and lateral view projections on each of said interpolated soft tissue regions and bone regions [Oosawa and Xu both disclose 3-D CT imagery, but not the projection of it at a particular viewing angle. The projection a 3-D image into a 2-D image of a particular view of the 3-D model was known to one of ordinary skill in the art as is evidenced by Qian (US 6226388) in column 1 lines 29-40 and would have been obvious to combine with Xu to allow viewing of the 3-D image on a 2-D media such as a typical display or printout.].

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Sonka et al., "Image Processing, Analysis, and Machine Vision" – edge enhancement techniques
- Oosawa (US 2001/0021263) – energy subtraction on 3-D CT images.
- Saito, "Three-dimensional Monochromatic X-ray Computed Tomography Using Synchrotron Radiation" – 3-D image views

Contact Information

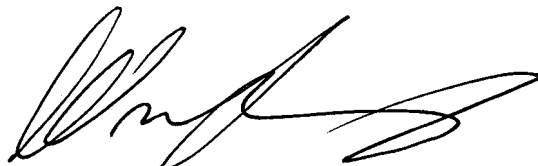
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan Bloom whose telephone number is 571-272-9321. The examiner can normally be reached on Monday through Friday from 8:30 am to 5:00 pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu, can be reached on 571-272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nathan Bloom

A handwritten signature in black ink, appearing to read 'Jingge Wu', is positioned above the printed name and title.

JINGGE WU
SUPERVISORY PATENT EXAMINER